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TWO NEW PROTEOCEPHALIDAE *

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The known Proteocephalidae have been the subject of an adequate study by La Rue (1914). The present paper treats of two new species belonging to the genus Proteocephalus, collected by the writer from the Bitter Root Valley, Montana, in 1915 and 1916. The host of one species, *Ptychocheilus oregonensis* (Richardson), is a cyprinid, while that of the other, *Coregonus williamsoni* (Girard), is a salmonid. In addition to the fact that these parasites have certain unique characters that readily distinguish them from described species, is the record of new hosts for the genus and the location of these worms in a new geographical area.

Proteocephalus ptychocheilus nov. spec.

Host: *Ptychocheilus oregonensis* (Richardson).
Locality: Carlton, Montana.
Date of Collection: April 12, 1915.

Small to medium-sized cestodes, reaching a maximum length of 200 mm. and a maximum breadth of 1.45 mm. Scolex about 1 mm. broad, neck practically as broad. Median fifth sucker lacking; marginal four suckers about 333μ in outer diameter, deep. Proglottids distinct from region about 5 mm. distal to neck. Anterior proglottids two to three times as broad as long. Maturing proglottids longer than broad. Ripe proglottids almost twice as broad as long.

Genital pore lateral, slightly anterior to middle of proglottid, in a shallow depression, sometimes on one side, sometimes on the other. Cirrus pouch constricted in outermost third, dilated in inner two-thirds. Ductus ejaculatorius coiled somewhat in inner dilated region of cirrus pouch; surrounded by prostate glands. Vas deferens consisting of tightly coiled tubule, especially massed in mid-plane of proglottid, with coil extending distad two-thirds distance toward ootype. Testes about 60, irregularly distributed in more than one plane, each about 80 to 110μ in diameter. Vagina opening proximal to cirrus pouch. Vagina traversing vas deferens obliquely. Sphincter vaginae weak, if present. Receptaculum seminalis consisting of a slightly dilated proximal portion of vagina. Vitellaria composed of small follicles, closely crowded together in lateral field just inside longitudinal muscle layers. Ovaries irregular, sacculate. Uterus consisting of six pairs of lateral pouches and a median ventral pocket. Eggs with three membranes, 19.4 by 23μ in diameter of outer membrane.

The specimens on which this study was made consisted of four worms secured from the stomach of a single half-grown female squawfish or chappaul, *Ptychocheilus oregonensis* (Rich.), taken from the

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* Contributions from the Zoological Laboratory of the University of Illinois, No. 146.

Bitter Root Valley, at Carlton, Montana, April 12, 1915. The worms were found free in the stomach along with a considerable amount of foodstuff. This host was infected also with *Holostomulum ptychocheilus* Faust.

The scolex of *Proteocephalus ptychocheilus* shows a blunt conical prominence with no indication of a fifth sucker. The four marginal suckers are superficially inconspicuous. Their general outline is spherical, while the long axis of the oval cup-like depression is at right angles to the surface of the cone (Fig. 1). The neck is hardly less broad than the head. Some little distance posterior to the head the worm becomes distinctly attenuated. In the region of maturing proglottids the segments are longer than broad (Fig. 2). Toward the distal end of the chain the proglottids assume a shape about one and two thirds as broad as long. In transection these proglottids are elongate oval.

The mature segments show all of the important sex organs. The genital pore is lateral, slightly proximal to the middle of the proglottid. It is situated in a slight depression; into it open cirrus pouch and vagina. The cirrus pouch is attenuate in its outer third. In this region the wiry cirrus organ is found. Internal to the band of the longitudinal muscles the cirrus pouch enlarges into a sacculate organ which is convexed ventrad. The ductus ejaculatorius works a sinuous course through the inner two-thirds of the contracted organ. The cirrus pouch as a whole occupies a region approximately one-third the width of the proglottid. It has a maximum width of 0.42 mm., and a diameter of 0.14 mm. From the region of the longitudinal muscle band to the innermost region of the pouch the ductus ejaculatorius is surrounded by a limited number of prostate glands. The vas deferens merges into the cirrus pouch imperceptibly. It is directed toward the middle field of the proglottid (Fig. 4), where a great mass of coils is found. Before the duct reaches the midpoint of the segment it turns distad and continues a sinuous course to a region somewhat proximal to the ootype. Here, in the distal third of the proglottid, it receives the vasa efferentia. The testes consist of about 60 oval bodies, located in more than one plane, mostly in the dorsal half of the worm (Fig. 4). They range in size from 80 to 110μ in diameter. Their connecting efferent ducts have not been observed.

The female organs have been observed as follows: The ovaries are a pair of glands in the distal portion of the proglottid, sacculate in outline, extending from the outer border of the vitellaria to the ootype. The organs are constricted internally so that a distinct T is formed with the oviduct junction. Soon after the oviduct emerges from the region of the ovary, it is surrounded by a definite sphincter (Fig. 5, *oc*), usually designated as the oocapt. It measures about 38μ in cross section. From the oocapt the oviduct has a sinuous course. Toward the ootype, a little distance dorsal to this organ, it is joined by the vagina. The outermost limit of this organ is at the genital pore proximal to the cirrus pouch (Fig. 3). It runs inward, paralleling that organ until it reaches the mass of coils of the vas deferens. Here it crosses under the pouch obliquely toward the midplane, where it is directed distad, and, after a few cramped sinuous bends, runs directly toward the ootype. In this vicinity it joins the oviduct. There is no distinct receptaculum seminalis. Perhaps the dilated proximal region of the vagina, just before it enters the oviduct, functions as such an organ.

The vitellaria are small, numerous follicles, closely compacted into a pair of cords, each within the lateral curve of the longitudinal muscle area. In the region of the ovaries transverse collecting ducts of considerable size converge dorsal to the ootype and the common vitelline duct resulting courses ventrad to join the common oviduct-vagina before the latter runs into the ootype. The ootype is surrounded by a spherical mass of closely crowded gland cells, with a gross diameter of about 230μ.

The uterus emerges from the ootype as a tube of narrow bore (Fig. 5, *u*). After a considerable amount of coiling it runs proximad on the ventral side of the proglottid. It gives rise to six pairs of lateral pouches and a single ventral pouch, the latter in the plane of the cirrus sac (Fig. 4, *up*). This constitutes the original outlet through which the eggs gain access to the outside. The outermost membrane of the subspherical egg measures 19.4 by 23μ. The middle membrane has an average diameter of about 17μ. The primary membrane measures 13μ in diameter. The egg is filled with yolk material.

Proteocephalus ptychocheilus is most nearly related to *P. esocis* (Schneider). However, size differences, structure and shape of cirrus pouch and vas deferens, number and size of testes, amount of vitellaria and details of structure in the vicinity of the ootype, all serve to distinguish the present species as new.

Proteocephalus laruei nov. spec.

Host: *Coregonus williamsoni* (Girard).
Locality: Fort Missoula, Montana.
Dates of Collection: Oct. 25, 1915; Feb. 18, 1916.

Small to medium-sized Proteocephalids, reaching a length of 100 to 120 mm., and a maximum breadth of 1.62 mm. Head and neck not observed. Maturing proglottids longer than broad. Ripe proglottids about one and one-fourth times as broad as long. Segments distinct.

Genital pore lateral, proximal to middle of proglottid. Cirrus pouch elongate, biconvex, extending mesad one-third the width of the proglottid. Cirrus large, muscular. Ductus ejaculatorius bending back on itself at least once within cirrus pouch. Vas deferens enlarges distad to enclose inner end of cirrus pouch. Coils of vas deferens comparatively few, in middle of the proglottid. Testes 40 to 50, in two planes, each testis 70 to 100μ in transsection. Vagina an attenuate tube proximal to cirrus pouch, describing a broad bow under the latter organ (Fig. 7) toward the ootype. Ovaries two, large, irregular. Vitellaria sparse, large, inside main longitudinal muscles. Uterus composed of nine lateral pouches; no ventral pouch observed. Eggs with three membranes, averaging 50 by 42μ in section.

The specimens from which this study was made were secured from two infections of *Coregonus williamsoni* (Girard), taken from the Bitter Root River at Fort Missoula, Mont., Oct. 25, 1915, and Feb. 8, 1916. In the first infection one specimen was found in the mid-intestine of the host. In the second infection five specimens were found attached to the wall of the intestine. In none of the specimens were the heads secured. The absence of the head and neck region makes the structure of the four suckers and the presence or absence of a fifth sucker a matter of conjecture. However, details of the mature and ripe proglottids identify this species as new.

The genital pore is marginal, irregularly alternating right and left. It comes almost to the surface of the marginal line, but at times shows a slight depression. The cirrus pouch is distal and slightly ventral to the vagina. The cirrus and ductus ejaculatorius are both short, so that the cirrus pouch extends mesad only about one fourth of the proglottid distance. The entire lumen is surrounded by a large number of closely grouped prostate glands. The inner end of the cirrus pouch projects into the enlarged outer portion of the vas deferens. It is reflexed acutely and reinforced by integument (Fig. 9). The vas deferens becomes slightly smaller as it courses toward the midfield of the proglottid. In this region it coils several times and here receives the vasa efferentia. The testes are distributed in two planes, mostly lateral to the uterine pockets. They number 40 to 50 and vary in cross section diameter from 70 to 100μ. The vasa efferentia have not been observed.

The vagina arises at the genital pore as a tube of small caliber. It runs mesad on the proximal side of the cirrus pouch and crosses under the vas deferens near the juncture of that organ with the cirrus pouch. It bends distad as it approaches the midfield and continues to the ootype (Fig. 7). The ovaries lie an appreciable distance from the distal margin of the proglottid. They are large irregular bodies, which may or may not become attenuated toward the midfield.

The vitelline follicles are large, sparsely scattered bodies, numbering about twenty on a side. They are often entirely lacking in sections of 8 to 10μ (Fig. 9). Their transverse collecting ducts unite to form a common vitelline duct which runs ventrad toward the ootype (Fig. 8).

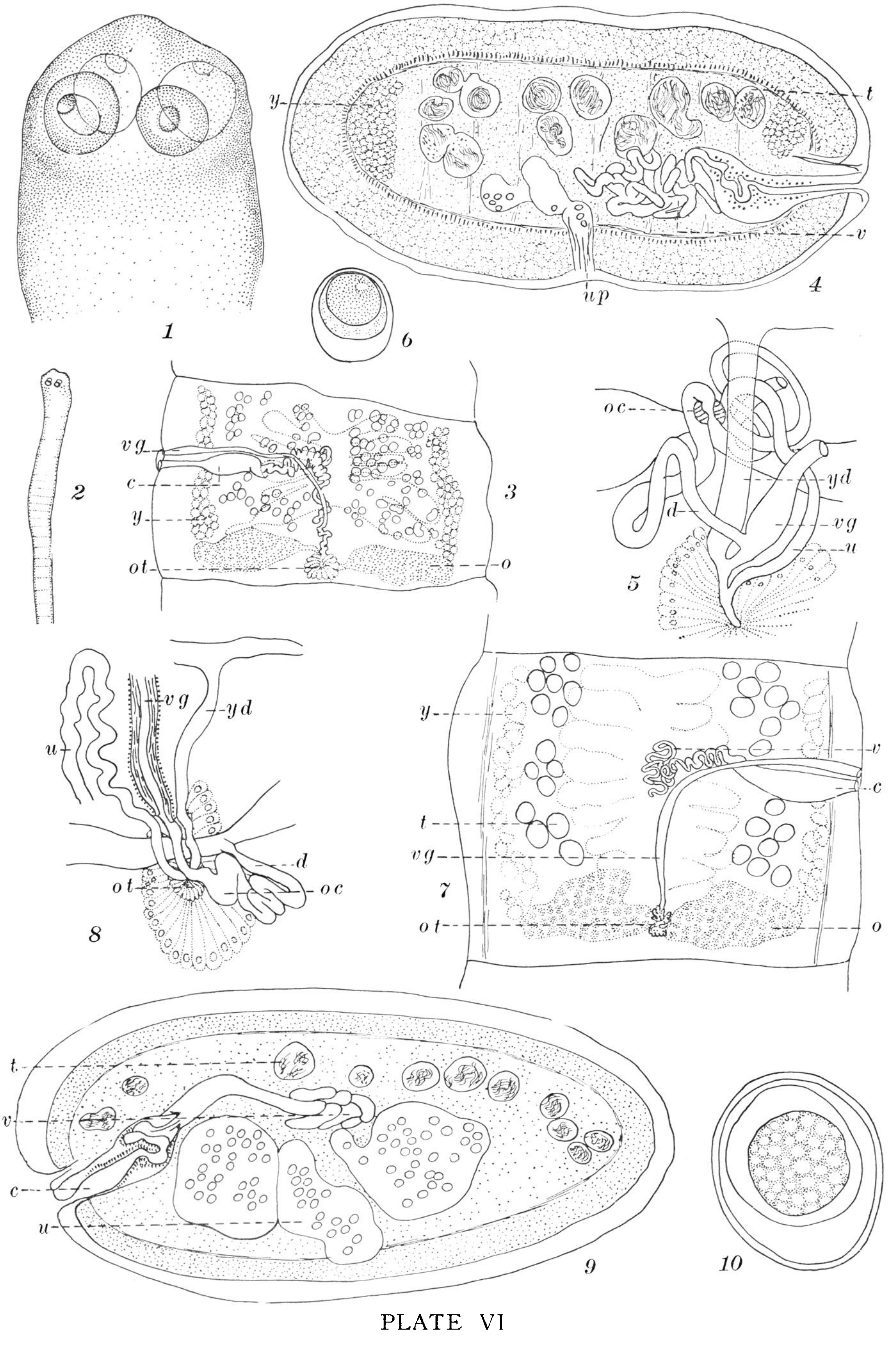
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PLATE VI

The ootype with its surrounding glands is a pyriform organ. The gland cells consist of two types: small, densely crowded ones immediately surrounding the ootype, and larger ones enveloping the whole. From the common limb of the two ovaries arises the oviduct which coils on itself several times, and, after passing through a muscular enlargement, the oocapt (*oc*), is joined by the vagina. Thence it runs into the ootype. The proximal end of the vagina consists of a thick wall well supplied with inner longitudinal and outer transverse muscles (*vg*), surrounding a small lumen. Between the junction of the vagina and the oviduct and the ootype the vitelline duct merges into the common duct, so that the combined products are emptied into the ootype through one duct. The uterus emerges from the ootype as a small sinuous tube. Proceeding proximad it enlarges to form nine irregular pockets on each side of the midline. No ventral pocket for the emission of the eggs from the uterus has been found. The eggs are enveloped in three membranes, an outer one of a heavy consistency, with a diameter of 42 to 50μ, a middle one some 39μ in transection, and an innermost one of 25μ measurement (Fig. 10). The egg is filled with a dense mass of vitelline granules.

Proteocephalus laruei bears some resemblance to *P. cernuae* (Gmelin) La Rue (1914). It differs in the distribution of the testes, in the number of the vitellaria, in the details of the cirrus pouch and in organs around the ootype. In addition, the structure of the egg membranes is different.

REFERENCE CITED

La Rue, G. R. 1914.—A Revision of the Cestode Family Proteocephalidae. Ill. Biol. Monogr., 1: 1-350, 16 pl.

DESCRIPTION OF PLATE

Proteocephalus ptychocheilus. 1. Enlarged view of head of worm, showing scolex, suckers and neck, × 34. 2. Habit sketch of anterior end, × 4. 3. View of mature proglottid, × 34. 4. Cross section of proglottid in region of cirrus pouch, × 54. 5. Diagram of organs in vicinity of ootype, × 105. 6. Egg, × 540.

Proteocephalus laruei. 7. Mature proglottid, × 34. 8. Detail of organs in region of ootype, × 105. 9. Cross section of proglottid in region of cirrus pouch, × 54. 10. Egg, × 540.

ABBREVIATIONS USED

c	cirrus pouch.	*u*	uterus
d	oviduct	*v*	vas deferens
o	ovary	*vg*	vagina
oc	oocapt	*up*	ventral uterus pocket
ot	ootype	*y*	vitellaria
t	testis	*yd*	vitelline duct